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PALEONTOLOGY.—*New genera of American Middle Ordovician "Cystoidea."*[1]

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Extinct primitive pelmatozoan echinoderms known as "Cystoidea" are so well represented in the national collections that I have been able to complete a considerable manuscript on the Ordovician species alone. As some time must elapse before publication of this can be expected, it was thought wise to describe and illustrate the new families and genera in advance, especially since they will thus be available for consideration in the treatise on invertebrate paleontology now in course of preparation under the auspices of the Geological Society of America, the Paleontographical Society, the Paleontological Society, and the Society of Economic Geologists and Paleontologists. In naming the new forms I have been guided by my feeling that as a part of its history any special and rare group of organisms like the present one should have its distinguished students represented by generic names in their honor.

Subphyllum PELMATOZOA Leuckart, 1848

Class EOCRINOIDEA Jaekel, 1915

SPRINGEROCYSTIDAE, n. fam.

Eocrinoidea in which the top of the theca is tubelike (*Springerocystis*) but may also be platform-shaped (*Columbocystis*) or consist of five broad, short, recumbent arms (*Foerstecystis*).

Springerocystis, n. gen.

Top of theca elevated into a short, tubelike, oral protuberance, with its upper margin formed by five thin oral plates arranged in a small circle. Named in honor of Dr. Frank Springer.

Genotype, *S. longicollis*, n. sp.

[1] Published by permission of the Secretary of the Smithsonian Institution. Received June 19, 1950.

Springerocystis longicollis, n. sp. Fig. 3

Theca elliptico-fusiform in outline below, terminating in an acute base of 2 mm and narrowing toward the top into an oral protuberance. Height 28 mm, greatest width 20 mm, anal area about 2.5 mm in diameter with its center 8 mm below top of oral protuberance.

Occurrence.—Blackriveran (Benbolt formation), Knoxville, Tenn.

Cotypes.—U. S. N. M. no. 93397.

Columbocystis, n. gen.

Summit of theca supports a flat platform composed of five thick, wedge-shaped, oral plates centering about a small oral aperture from which diverge one anterior and two lateral narrow food grooves, the lateral ones branching within 1 mm. The food grooves terminate in five facets on the lateral sides of the platform to which the brachioles were attached and curving upward became erect.

Genotype, *C. typica*, n. sp.

Columbocystis typica, n. sp. Figs. 1, 2

Theca oval, with a conspicuous flattened protuberance at the top; height 24 mm, width 18 mm. Anterior outline distinctly gibbous along its upper third, while the posterior presents its strongest convexity at midheight. From a lateral point of view the major axis of the theca appears oblique, extending from the upper anterior toward the lower posterior thecal border, and the upper flattened face of the food-groove platform slopes in the same general direction. The platform, 8 mm in width and 6.5 mm long from front to rear, consists of five plates 2.5 to 3 mm in height extending laterally beyond the upper margins of the supporting thecal plates. These plates form an elevation about 2 mm in height and 6 mm in diameter immediately beneath the platform.

Occurrence.—Blackriveran (Benbolt formation), Rye Cove, Scott County, Va.

Cotypes.—U. S. N. M. no. 93407.

Foerstecystis, n. gen.

Like *Columbocystis* in general form but characterized by five relatively broad arms recumbent upon top of theca. Antanal side bears the strongly excentric base. Anal side very gibbous, especially toward lower end of theca, where it is angularly protuberant in a nearly horizontal direction. Plates much reduced in number and angulations connecting their centers correspondingly accentuated. Named in memory of Dr. A. F. Foerste.

Genotype, *F. obliqua*, n. sp.

Foerstecystis obliqua, n. sp. Figs. 11, 12

Theca irregularly rotund in outline; cotypes each about 10 mm high and 8 mm wide. Anterior side presenting a strongly convex vertical outline or hump, which reaches its maximum convexity about 6 mm from the anterior arm of the food-groove system. Posterior outline strongly protuberant near the midheight of the specimen, and still more so at its lower margin, where it terminates in a rounded point fully 8 mm distant from the pointed base of the specimen in a horizontal direction. Oral end of theca supports a sessile food-groove system, with five branches or arms, each 4 mm long and 2.5 mm wide spreading over an area 7 or 8 mm in diameter.

Occurrence.—Blackriveran (Benbolt formation), Knoxville, Tenn.

Cotypes.—U. S. N. M. no. 93400.

BATHEROCYSTIDAE, n. fam.

Proposed for the unusual new genus *Batherocystis*, named in memory of Dr. F. A. Bather. Family characters now necessarily those of the genus

Batherocystis, n. gen.

Theca oblong, strongly flattened, with the lateral margins of the flattened sides tapering decidedly toward the base. Anal opening relatively large, located along the upper part of one of the lateral margins.

Genotype, *B. appressa*, n. sp.

Batherocystis appressa, n. sp. Figs. 4, 5

Theca strongly compressed, presenting two flat sides connected by a narrowly rounded margin. Flat sides oblong in general outline but narrowed to a point slightly over 2 mm wide at the base. Height 25 mm, width 12 mm, thickness of theca, from one flattened surface to the other, about 1.7 mm. Anal area located on one of the narrowly rounded thecal margins, oval in outline, 2.5 mm in diameter vertically and 1.9 mm laterally, with its center 5 mm below the top of the theca.

Occurrence.—Chazyan (Lenoir limestone), Knoxville, Tenn.

Holotype.—U. S. N. M. no. 99394.

Class PARACRINOIDEA Regnéll, 1945

Family MALOCYSTITIDAE Bassler, 1943

Billingsocystis, n. gen.

Theca ovoid-oblong slightly flattened, with food-groove system imperfectly known but apparently confined to a single short, transverse, relatively deep, semilunate groove. No branches of this groove and no facets for the attachment of arms are present. Thecal plates many, all strongly ridged in a direction radiate to the angles. Columns cylindrical consisting of very thin columnals attached to the invaginated base. Named in remembrance of Elkanah Billings.

Genotype, *B. invaginata*, n. sp.

Billingsocystis invaginata, n. sp. Fig. 17

Theca oblong, moderately flattened laterally, base invaginated, with the column attached to its central part. Height 27 mm, greatest width 25 mm, least width 22 mm, depth of invagination about 2 mm. Anal area nearly 3 mm in diameter, with its center about 6 mm below the level of the top of the theca. Theca consisting of approximately 175 plates; 8 or 9 of these occur in a distance equaling the height of the theca. Ornamenting ridges radiating from raised centers of the plates toward their angles are narrowly angular, have sharp crests, and enclose intermediate flat triangular areas.

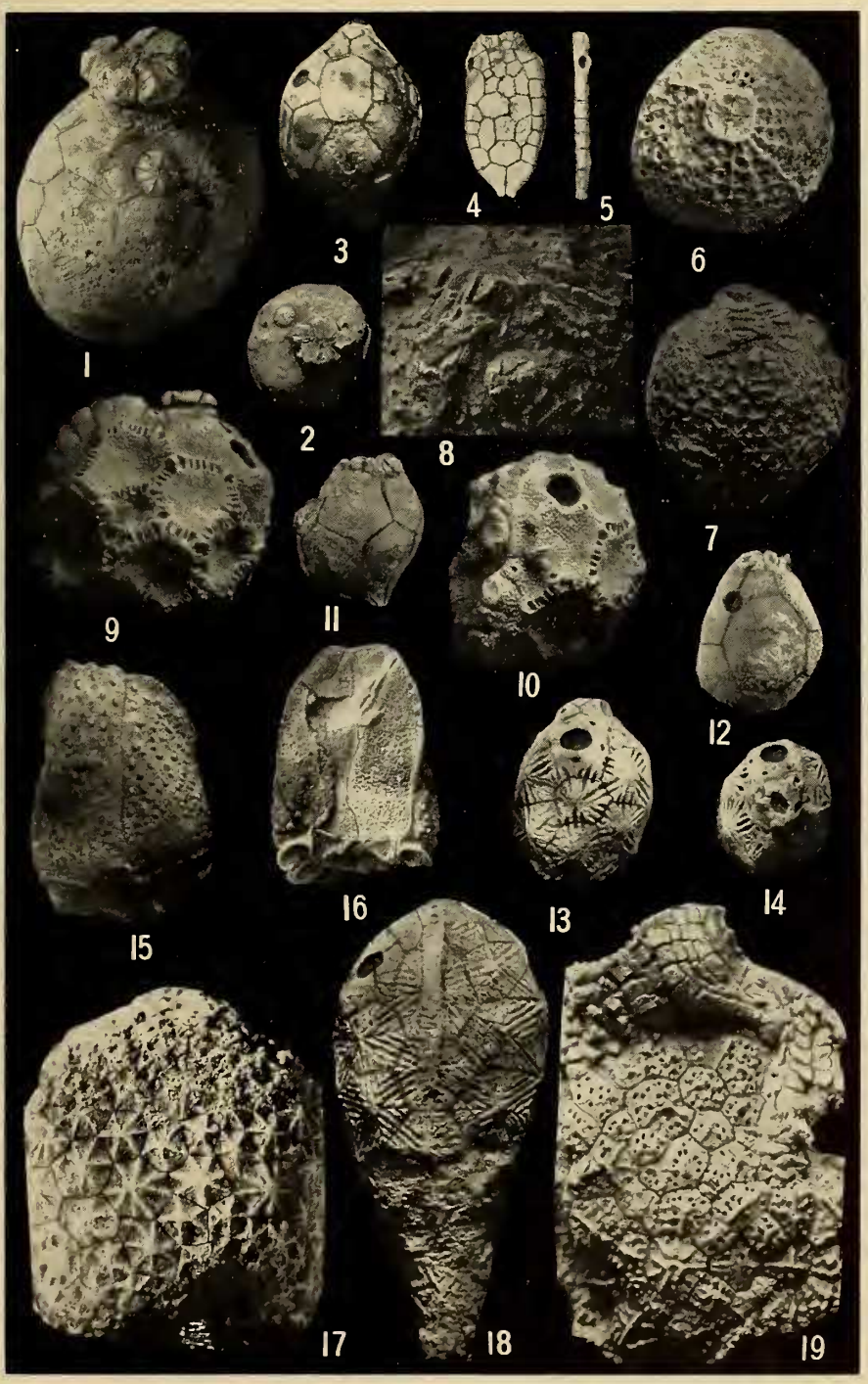
Occurrence.—Lower Trenton (probably Curdsville member), on the Versailles and Troy Pike, in Woodford County, Ky.

Cotypes.—U. S. N. M. no. 53110.

Family COMAROCYSTITIDAE Bassler, 1943

Schuchertocystis, n. gen.

Theca resembling a small *Amygdalocystites* but lacking recumbent arms. The base consists of three plates, two on the antanal and one on the anal side. Plate sutures crossed at right angles by long slits in the mesostereom that shorten at their passage through the hypostereom into ellip-



FIGS. 1–19.—1, 2, *Columbocystis typica*, n. gen. and sp., side view slightly tipped to show anal pyramid, × 2, and top view, × 1; 3, *Springcrocystis longicollis*, n. gen. and sp., side view with anal opening to left, × 1; 4, 5, *Batherocystis apprcssa*, n. gen. and sp., side and edge views with anal opening, × 1; 6–8, *Regnellicystis typicalis*, n. gen. and sp., basal and side views, × 2, and part of latter enlarged; 9, 10, *Sinclairocystis praedicta*, n. gen. and sp., side view, × 2, with anal pore to right and top view with two arms on left, × 2; 11, 12, *Foerstecystis obliqua*, n. gen. and sp., two cotypes, × 2, one showing the anal opening and the other the opposite side; 13, 14, *Schuchertocystis radiata*, n. gen. and sp., anal and top views, × 2; 15, 16, *Kirkocystis papillata* (Bassler, 1943) (Enoploura?), convex and opposite side of two cotypes, × 4; 17, *Billingsocystis invaginata*, n. gen. and sp., side view of one of the cotypes, × 2; 18, *Ulrichocystis eximia*, n. gen. and sp., anal opening and traces of arm, × 2; 19, *Strimplccystis oklahomensis*, n. gen. and sp., the fragmentary type, × 2, showing plates with diplopores and remains of arms.

tically elongate pores. Named in remembrance of Dr. Charles Schuchert.

Genotype, *S. radiata*, n. sp.

Schuchertocystis radiata, n. sp. Figs. 13, 14

Theca 13 mm high, 7.5 to 9.5 mm wide, ovate in lateral outline, flattened in a direction oblique to the axis passing through the anal area. From the widest part, about 4 mm below the top a short distance below the anal area, the theca narrows downward to a width of 8 mm at a point 5 mm above its base, which is about 1.5 mm in width where it was probably attached to a column of still smaller dimensions. The latter is located strongly excentrically on the antanal side of the theca. The lower part of the thecal outline along its anal side is strongly protuberant, while on the antanal side it is relatively straight.

Occurrence.—Blackriveran (Benbolt formation), Washburn, Grainger County, Tenn.

Holotype.—U. S. N. M. no. 53108.

Sinclairocystis, n. gen.

Like *Comarocystites*, but instead of having four free arms it has two recumbent ones rising vertically from the theca. Named in honor of Dr. G. Winston Sinclair, who had predicted the occurrence of this type of cystoid just preceding its discovery.

Genotype, *S. praedicta*, n. sp.

Sinclairocystis praedicta, n. sp. Figs. 9, 10

Represented by four specimens, of which the holotype, 20 by 20 mm high and wide and 15 mm thick, best exhibits the characteristic *Comarocystites* plate structure and shows the two recumbent arms of stout plates extending about two-thirds of the way to the base.

Occurrence.—Blackriveran (Bromide formation, near top of green shale), 1.8 miles south of Sulphur, Okla.

Holotype.—U. S. N. M. no. 116332.

Class CYSTOIDEA Von Buch, 1846

Order RHOMBIFERA Zittel, 1879

ULRICHOCYSTIDAE, n. fam.

Characters same as in the genus.

Ulrichocystis, n. gen.

Theca fusiform, with an elliptical opening at its oral end surrounded by six thecal plates but with only a trace of a recumbent arm with facets for the support of brachioles. The genotype resembles *Palaeocystites dawsoni* in the arrangement of a large part of the thecal plates in vertical rows, but it differs in having only three plates in the basal series. Dedicated to Dr. E. O. Ulrich.

Genotype, *U. eximia*, n. sp.

Ulrichocystis eximia, n. sp. Fig.18

Theca fusiform or clavate in outline; height 34 mm, greatest width 15.5 mm, least width 13 mm in the same plane. The greatest width is located 10 mm below the top of the theca, from which point to the base the rate of tapering is very even. Diameter of base slightly over 3 mm. The elliptical opening at the oral end is 2.5 mm long and 1.4 mm wide, slightly broken along one edge where its width is 2.0 mm. The six surrounding plates rise gently at the margin, leaving it sharp-lipped. The anal area is 2.9 to 3.4 mm in diameter in different directions, with its center about 5 mm below the top of the theca, which consists of approximately 75 plates chiefly hexagonal in outline. The basal series is composed of three elongated plates, surmounted by a second series consisting of five plates, of which the one of the antanal side is conspicuously longer. Surmounting the five plates in the second series are five vertical rows, each including six plates, not counting the circumoral plates or those belonging to the second series.

Occurrence.—A single specimen from Luttrell, Tenn., in the Benbolt formation.

Holotype.—U. S. N. M. no. 93398.

Order DIPLOPORITA J. Müller, 1854

REGNELLICYSTIDAE, n. fam.

Regnellicystis, n. gen.

This interesting diplopore is characterized by its broadly oval theca, 15 mm high and 14 mm wide, arising from four sharply marked basals and composed of many uncommonly small plates, all radially arranged and divided by sharp ridges into several compartments each pierced by a single large diplopore. In addition, the type specimen bears an anal pyramid about 2 mm wide located 3 to 5 mm below the thecal top. The latter bears five simple food grooves extending to the lower level of the pyramid and lined with thin flat brachioles. Named in honor of Dr. Gerhard Regnéll.

Genotype, *R. typicalis*, n. sp.

Regnellicystis typicalis, n. sp. Figs. 6–8

Description as above.

Occurrence.—Blackriveran (Benbolt formation), Rye Cove, Scott County, Va.

Holotype.—U. S. N. M. no. 113308.

Strimplecystis, n. gen.

Characters as in the specific description. Named in honor of Melba and Harrell Strimple.

Genotype, *S. oklahomensis*, n. sp.

Strimplecystis oklahomensis, n. sp. Fig. 19

Type and only specimen, a fragment of a calyx of many rather large radially arranged plates each pierced by a dozen or more diplopores much as in *Eumorphocystis* Branson and Pack, 1940, but differing in still preserving two short, unbranched food grooves out of probably five, each lined with a series of thin flat plates serving as brachioles. The rest of the specimen is such a jumble of plates that additional examples are necessary for more information. The tentative position assigned above seems the best under the circumstances.

Occurrence.—Blackriveran (Bromide formation, 140 feet below top), Oklahoma State Highway 99, Sec. 22, T. 1 N., R. 6 E., Oklahoma.

Holotype.—U. S. N. M. no. 115193.

Class CARPOIDEA Jaeckel 1900

Family ANOMALOCYSTITIDAE Bassler, 1943

Kirkocystis, n. gen. Figs. 15, 16

This new generic name, proposed in honor of Dr. Edwin Kirk, is based upon a carpoid related to *Enoploura* but differing in that the theca is composed of only two large elongate plates on the convex side and three equally long plates on the concave side. Typical *Enoploura* develops three plates in both the marginal and middle series of both sides: The surface ornamentation of small distinct papillae separated by very minutely reticulated spaces is another feature of *Kirkocystis*.

Genotype, *Enoploura? papillata* Bassler, 1943 (Amer. Journ. Sci. **241**: 695, pl. 1, figs. 3–5. 1943).

Occurrence.—Blackriveran (40′ below top Bromide formation), Rock Crossing, Criner Hills, Sec. 35, T. 5S., R. 1 E., Oklahoma.

Cotypes.—U. S. N. M. no. 113105.

PALEONTOLOGY.—*New stropheodontid brachiopods.*[1] ALWYN WILLIAMS, Glasgow University. (Communicated by G. A. Cooper.)

The following descriptions are part of a recently completed morphological and systematic study of stropheodontid Brachiopoda of North America and Europe. The proposed systematic revision will be used in a forthcoming publication on British Silurian brachiopods and is here given in outline because the results as a whole will not be in print for some time.

Most of the types are located at the U. S. National Museum, and I take this opportunity to express my deep appreciation to the authorities of the Smithsonian Institution for making all their collections available to me, and my grateful thanks to Dr. G. Arthur Cooper, curator of invertebrate paleontology and paleobotany, for helpful criticism and advice during my investigations.

Family STROPHEODONTIDAE Caster

Hercostrophia, n. gen. Figs. 1–6

Exterior.—Transversely semioval, gently concavo-convex to almost biplanate. Pseudodeltidium entire with a narrow median fold, chilidium vestigial. Ornamented by finely parvicostellate ribbing with accentuated primaries.

Ventral interior.—Hinge-line denticulate for about three-quarters its length. Diductor scars elongate, divergent, each contained by an outer and inner lateral, obtusely triangular ridge, the apices of which meet posterolaterally to form a narrow ring of shell deposit around each scar. Adductor scars fine, lanceolate, impressed posteriorly on either side of a low median ridge.

Dorsal interior.—Cardinal process lobes disjunct, socket plates vestigial. Adductor scars faintly impressed posteriorly to two pairs of ridges, an inner tuberculate pair, and an outer, low, somewhat indistinct pair.

Genotype.—Hercostrophia alpenensis, n. sp.

Range.—Middle Devonian.

Discussion.—The new genus includes an American group of shells presumably divergent from the shalerid stock. These forms differ from their shalerid contemporaries in the encirclement of the diductor muscle scars by the inward growth of the apices of the bounding ridges, the strong curvature to the outer bounding ridges, and the corresponding splayed flabellate appearance of

[1] Received May 17, 1950.